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think it worth while to mention in the *Monthly Notices* that I find the dusky ring of *Saturn*, which I believe has only been seen by rather large telescopes, is discernible with much smaller instruments; and that the possessors of such may look for a sight of this interesting appendage to the planet with every chance of success. On the night of Thursday, 20th October, the slate-coloured interior ring was beautifully seen in my telescope of only 4 feet focal length, with an aperture of 3⅜ inches. The eye-piece was an Huyghenian one, giving a power of 480. Not anticipating that the telescope would show it, I had not looked for it, but had my attention drawn to it by the inquiry of a friend, 'Why half the space between the ring and the planet was lighter than the rest?' Upon looking myself, I immediately recognised the dusky purplish light and well-defined inner boundary of the ring in question, occupying about a third of the space from the bright inner ring, and also saw its dark line across the body slightly broader at the ends than in the middle. Other persons also verified the observation. This was between 10 and 11·30 G.M.T. The atmosphere was excessively moist, and the sky rather hazy; but I have never seen the detail of the moon and *Saturn* to greater perfection than on that evening. I do not suppose that many telescopes so small as my equatoreal will show this ring, as my object-glass (by Ross) is a very fine one; but I should think good 5-feet telescopes, of 3¼ inches aperture, which are in the possession of so many amateurs, would."

On Rating Chronometers by Lunars. By H. Toynbee, Esq., Commander of the Gloriana, East Indiaman.

In vol. ix., No. 7, of the proceedings of the Royal Astronomical Society, dated May 11, 1849, will be found the notice of a paper "On the Practicability and Advantages of obtaining a Sea-rate for a Chronometer," which is published entire in the *Nautical Magazine* for February 1850.

In the paper alluded to, I endeavoured to prove how a good practical observer of lunars could obtain a better sea-rate for his chronometer than that supplied by the maker, and than one determined by other means during the ship's stay in port, also an original error which very rarely gives an error on Greenwich mean time of more than twenty seconds.

A general opinion seemed to be that I was correct, so far as my own observations were concerned, but that lunar observers generally could not apply the method satisfactorily.

My present object is to prove this objection erroneous. Late in 1850 I took the command of another ship, my chief officer during this voyage, on account of the delicate state of his health, was prevented from taking lunars.

In 1851, Mr. J. W. Quihampton (now commander of the Tudor) became my chief officer, and continued so until the middle of September 1853. He had been in the habit of taking lunars, but, like almost all persons with whom I have conversed on the subject, had been taught that the best lunars could not be depended upon

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within fifteen miles of longitude, so did not think it possible to rate chronometers by them.

This opinion (which I believe to be almost universal amongst seamen) must be set aside, and the method, which is fully explained in the *Nautical Magazine* for February 1850, fairly tried. Mr. Quihampton did so, and I proceed to give a comparative view of the errors and rates of Dent's 1759 chronometer, found by his observations and my own, together with those by the gun at Madras, the ball at St. Helena, and the maker on arriving in England.

	Mr. Quihampton's Original Error. Fast of G.M.T.	Daily Rate. Gaining.	My Own. Original Error. Fast of G.M.T.	Daily Rate. Gaining.	Various Sources. Original Error. Fast of G.M.T.	Daily Rate. Gaining.
	m s	s	m s	s	m s	s
May 14	⊙ E. ☾ 38 19·3		⊙ E. ☾ 39 22·3			
	⊙ W. ☾ 40 10·7	8·9	⊙ W. ☾ 39 31·1	9·4	Flash of Madras Gun.	
	Mean 39 15		Mean 39 26·7		39 22·7	9·3
30	⊙ W. ☾ 42 43·4		⊙ W. ☾ 42 19·1			
	⊙ E. ☾ 41 18·9	9·5	⊙ E. ☾ 42 55·4	10·5		
	Mean 42 1·1		Mean 42 37·3			
June 12	⊙ E. ☾ 43 17·3		⊙ E. ☾ 45 4·0			
	⊙ W. ☾ 44 34·4	9·1	⊙ W. ☾ 44 20·1	9·9		
	Mean 43 55·8		Mean 44 42·1			
July 2	⊙ W. ☾ 47 34·4		⊙ W. ☾ 46 49·5			
	⊙ E. ☾ 46 16	9·0	⊙ E. ☾ 47 6·3	7·6		
	Mean 46 55		Mean 46 57·9			
13	⊙ E. ☾ 47 45·1		⊙ E. ☾ 48 23·3			
	⊙ W. ☾ 48 45·8	8·1	⊙ W. ☾ 47 54·7	7·0	St. Helena Ball.	
	Mean 48 15·4		Mean 48 9		47 54·5	
30	⊙ W. ☾ 51 6·9		⊙ W. ☾ 50 7·2			
	⊙ E. ☾ 50 9·5	8·3	⊙ E. ☾ 50 47·8	7·9		
	Mean 50 38·2		Mean 50 27·5			
Aug. 10	⊙ E. ☾ 51 50·7		⊙ E. ☾ 52 21·3			
	⊙ W. ☾ 53 2·9	9·2	⊙ W. ☾ 51 52·3	8·5	Maker's Error brought back by Maker's Rate.	
	Mean 52 26·8		Mean 52 6·8		52 9·5	
					Maker's Error and Rate.	
15	……		……		56 47·5	8·0

Note.—Each date applies to all the results on the same line with it.

We were only one day in St. Helena, so could obtain no rate by the ball. The ship arrived in the East India Docks on the 13th September, the chronometers were taken by the maker on the 14th, and the daily rate gradually decreased to $6^{s}\cdot5$ during the first five days.

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On referring to the above table it will be noticed that in Mr. Quihampton's case, the ☉ W. ☾ lunars invariably give the greater, but in mine almost as invariably the lesser error. This may arise from a constant error in the observer, or his instrument; but the means of our ☉ E. ☾ and ☉ W. ☾ errors nearly agree.

The differences between our rates found at the same time, the mean of which is eight-tenths of a second, are reduced by taking a mean between the new rate and the one previously found. In cases where the chronometers, by their second differences, prove themselves to have been going regularly since the previous rate was obtained, I strongly recommend this to be done.

Since leaving Madras, Mr. Quihampton has rejected three sets of sights, and I two, they were deemed but indifferent observations before working them. In several instances lunars were obtained on only one day of the sun and moon's continuing in distance.

Both sextants were by Cary. Mr. Quihampton always used green and red shades, I a blue one; the same shades were always used, and the instruments placed as near as possible in the same state for each observation, as more fully explained in my first paper.

We each took and worked two sets when practicable, to check errors of calculation. They were both taken at the same sitting. Mr. Quihampton's set consisted of three, mine of five, sights.

The first part of the voyage was to Port Phillip, where the chronometers were not rated, still we found on arriving at Madras that by applying the lunar errors we had the Greenwich time within a few seconds.

During the passage from Madras to London, we had a furious gale off the Cape on June 23, 1853, and the second difference of the chronometers decreased twelve seconds before arriving at St. Helena, still we hove to at 4 A.M., July 12th, and at daylight found the island bearing north-west ten miles as expected.

Early on the morning of Sept. 8th we sighted the Eddystone lighthouse, when the cross-bearings and sights computing with the lunar error, placed us in the same position to a mile and a half.

I think the preceding table shows why lunars are not considered correct within fifteen miles of longitude, because most of Mr. Quihampton's errors, taken separately, give the longitude that much wrong. It was the same with mine until the sextant was carefully adjusted by the maker.

I think it has also proved that there is a constant character in lunars taken by the same observer, using the same instrument in the same state; whereby any person having practised this method for a short time, may readily show how much a single set of lunars gives the Greenwich time in error. For instance, Mr. Quihampton's ☉ W. ☾ and ☉ E. ☾ lunars differ in the Greenwich time about one minute and twenty seconds; now the half of this, or forty seconds of time, may be called his constant error; mine differ about twenty-nine seconds, so that my constant error is fifteen seconds of time, which applied to any single set of observations will give the

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Greenwich time very nearly correct: hence an observer having ascertained his constant error, has the true longitude from a single set, taken either ⊙ E. ☾ or ⊙ W. ☾.

This voyage my constant error has been very nearly the same throughout. Last voyage the ⊙ E. ☾ lunars gave eighteen seconds more subtractive error than the ⊙ W. ☾ on the passage out to India, and thirty seconds less during the passage home. I am of opinion that this difference arose from a change in the state of the sextant during our stay in port.

What I consider to be new in this method is, its enabling an observer of lunars to find rates for chronometers each fortnight of his voyage, and so to mean ⊙ E. ☾ and ⊙ W. ☾ lunars—though several days have elapsed between the observations—that he obtains an original error for chronometers, which is very near the truth, and a constant error for himself, by the application of which a single set of lunars gives the true longitude. I have practised the method for nearly five years, and it has never misled me in determining the ship's position. My knowledge of the general accuracy of other observers convinces me that they may do the same, which, I think, this paper proves.

It cannot be too generally known that lunars a month old are very valuable. I have the calculations from which my errors and rates are deduced. They are at the service of any person wishing to see them.

Report of the Radcliffe Observer to the Board of Trustees, July 1, 1853.

The principal event reported upon is the completion of the electric communication between the Radcliffe Observatory and the Royal Observatory of Greenwich. The difference of time between the two Observatories has not yet been determined.

Since the last meeting two volumes of the Radcliffe Observations have been published, which bring down the published records of the Observatory to the end of 1851. The Observations for 1852 are stated to be ready for the press.

The calculations for the Catalogue of Circumpolar Stars, which were committed to Mr. Luff, have been brought down to the period of the last published volume; and it is expected they will be altogether completed before the next meeting of the Board.

Mr. Johnson proposes printing the Catalogue separately as a supplement to the fourteen volumes of Observations, of which it will contain the substance, retaining the same form and type.

The Heliometer continues to maintain its high character. Two years' experience has pointed out certain minor faults, which Mr. Johnson believes to be remediable; but he is waiting the completion of a long series of observations on which he has been engaged before he communicates with the maker on the subject. Such is the power of the instrument, that he believes a change of